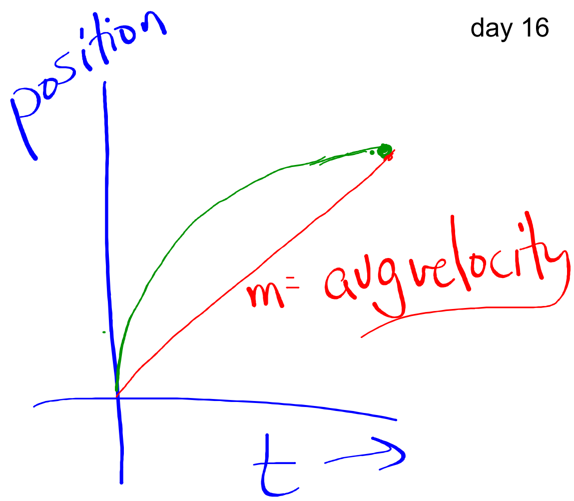
The derivative (3.1 - 3.2)

day 16

Average velocity

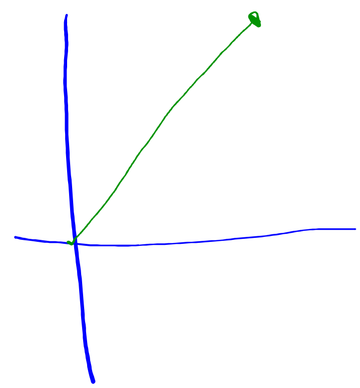
$$\frac{\text{chg in position}}{\text{chg in time}}$$



Instantaneous velocity

$$\lim_{t \to I} \frac{\text{chg in position}}{\text{chg in time}}$$

$$\lim_{t \to I} \frac{P(t) - P(I)}{t - I}$$



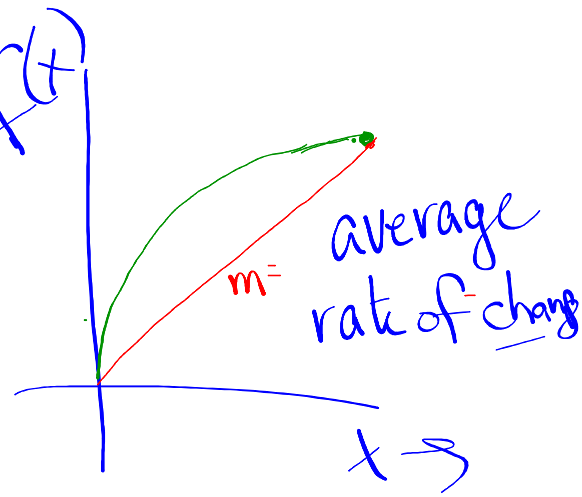
The derivative (3.1 - 3.2)

day 16

The average rate of change of $f(x)$ between $x=a$ and $x=b$ is

a) the slope of the line joining $f(a)$ and $f(b)$

b) $\dfrac{f(b)-f(a)}{b-a}$



The derivative

The derivative (3.1 - 3.2) day 16

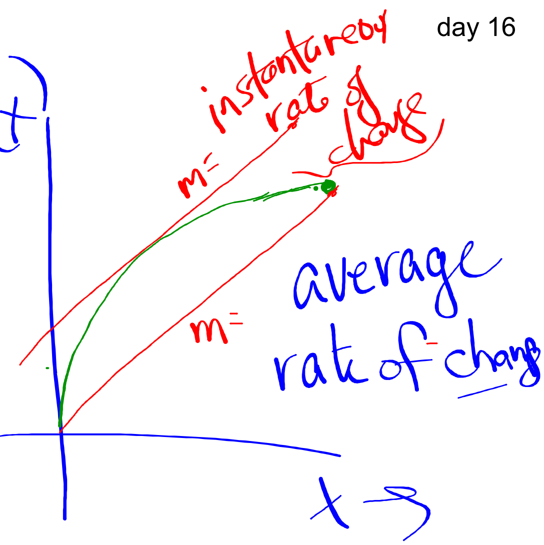
The instantaneous rate of change f(t)

of $f(x)$ at

$x = a$ is

a) the slope of the TANGENT line AT $x = a$

b) $\lim_{b \to a} \frac{f(b) - f(a)}{b - a}$



The derivative

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The derivative (3.1 - 3.2) day 16

1) use def (1) ... to explain how slopes of secant lines approach the slope of the tangent line AT A POINT

$x=a$

def 1)

$$m_{TAN} = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

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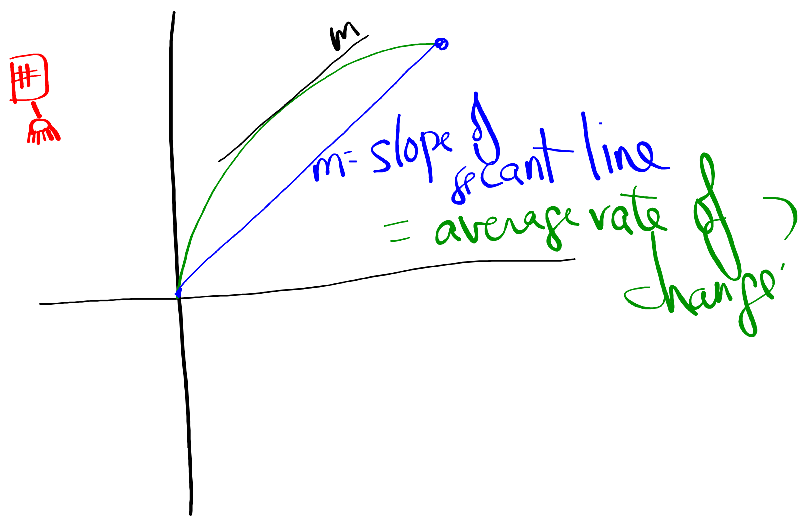
The derivative (3.1 - 3.2)

day 16

3.1/2 Explain WHY the slope of the secant line can be interpreted as average rate of chg.



The derivative (3.1 - 3.2)

day 16

3.1/3 Explain WHY the slope of the tangent line can be interpreted as an instantaneous rate of change.

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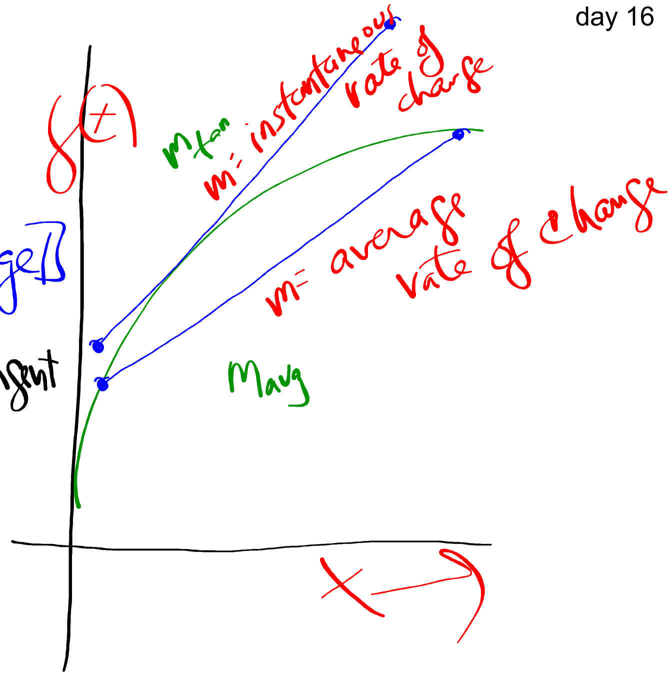
The derivative (3.1 - 3.2)

day 16

The derivative

[[the instaneous rate of change]]

[[slope of the tangent line]]



$$f'(a) = \lim_{x \to a} \frac{f(x)-f(a)}{x-a}$$

"f'" is called the derivative of f(x)

The derivative (3.1 - 3.2)

day 16

Equation of a line

$y = mx + b$

"write the equation of the line with slope = 2 through P = (1, −7)"

$(y - (-7)) = 2(x - 1)$

Point-Slope form

$y - y_1 = m(x - x_1)$ where m is the slope, (x_1, y_1) is ANY point on the line

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The derivative (3.1 - 3.2)

day 16

3.1/9) $f(x) = x^2 - 5$, $P(3,4)$

$x = a$

$$f'(3) = \lim_{x \to 3} \frac{f(x) - f(3)}{x-3}$$

$$= \lim_{x \to 3} \frac{(x^2-5)-(4)}{x-3} = \lim_{x \to 3} \frac{x^2-9}{x-3}$$

$$= \lim_{x \to 3} \frac{(x-3)(x+3)}{(x-3)} = \lim_{x \to 3} (x+3) = 6$$

$f'(3) = 6$; $P = (3,4)$

Pt-slope form

Eqn of tan line: $y - 4 = 6(x-3)$

The derivative (3.1 - 3.2)

day 16

Pt slope

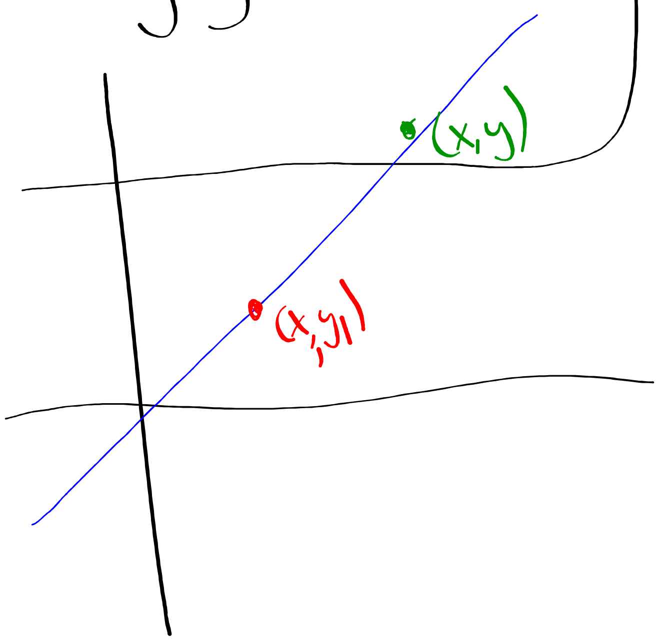
$$y - y_1 = m(x - x_1)$$

$P_1 = (x, y)$, $P_2 = (x_1, y_1)$

$$m = \frac{y_1 - y}{x_1 - x} = \frac{y - y_1}{x - x_1}$$

$$\Downarrow$$

$$m(x - x_1) = y - y_1$$



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The derivative (3.1 - 3.2)

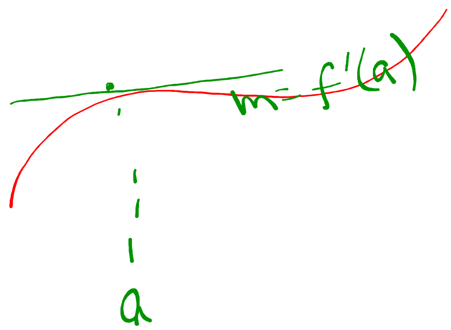
day 16

$$\boxed{f'(a) = \lim_{x\to a} \frac{f(x)-f(a)}{x-a}}$$

for the function $f'(x)$

$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{\underbrace{(x+h)-x}_{=h}}$$

$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$



The derivative (3.1 - 3.2) day 16

Alternative notation

Gottfried Leibniz of Germany

$f'(x)$ $\qquad$ $\frac{dy}{dx}$ "i.e $\lim \frac{\Delta y}{\Delta x}$" if $y=f(x)$

2.6 / 71-73, 84, 86, 93

3.1 / 15, 17-20, 27-30, 37

$\dot{f}$ ↳ Newton & Physics

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